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Molluscicides Efficacy of Leaf Powders from *Agave angustifolia*, Cashew and Rambutan on Mortality of the *Golden Snails (Pomacea canaliculata* L.)

Hamzah Hamzah[1,3*], Sylvia Sjam[2], Ahdin Gassa[2] and Tamrin Abdullah[2]

[1]Doctoral Program of Agricultural Science, Graduate School Hasanuddin University, Makassar, Indonesia; [2]Department of Plant Protection, Faculty of Agriculture, Hasanuddin University, Makassar, Indonesia; [3]Department of Agroteknologi, Faculty of Agriculture, Muhammadiyah Makassar University, Makassar, Indonesia
*Corresponding author's e-mail: hamzah.esa@unismuh.ac.id

Golden snail is one of the main pests on rice plants. This pest is an invasive species that is difficult to control. This study aims to test the efficacy of molluscicide of Agave angustifolia, Cashew, and rambutan leaves against golden snails. Molluscicide of leaf powder is obtained by drying the leaves using a dehydrator and then powdered with a size of 100 mesh using an herb grinder. Molluscicide of leaf powder of Agave angustifolia and cashew with concentrations of 0.5 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L caused 100% of gold snail mortality at 24 hours of exposure. Meanwhile, molluscicide of leaf powder of rambutan with concentrations of 0.5 gr/L, 0.75 gr/L, 1.00 gr/L and 1.25 gr/L caused 100% mortality at 36 hours of exposure. The results of probit analysis within 24 hours after exposure to molluscicide of leaf powder of Agave angustifolia had LC50:0.36 gr/L, LC90:0.46 gr/L, and cashew leaves had LC50:0.32 gr/L, LC90:0.42 gr/L, while rambutan leaves had LC50:0.69 gr/L, LC90:1.37 gr/L. Mortality caused by the molluscicide of leaf powder of agave angustifolia was significantly different from the molluscicide of leaf powder of rambutan. The mortality caused by the molluscicide of leaf powder of cashew is was significantly different from the molluscicide of leaf powder of rambutan. Mortality caused by molluscicide of leaf powder of Agave angustifolia is no significantly different from molluscicide of leaf powder of cashew. Molluscicide of leaf powder from agave angustifolia, cashew, and rambutan is effective as a molluscicide because it can cause high mortality in golden snails. Molluscicide of leaf powder of cashew is more effective than molluscicide of leaf powder of agave angustifolia and rambutan.

Keywords: Golden snail; leaf powders; molluscicide; Agave angustifolia, Cashew, rambutan, Nephelium lappaceum; *Anacardium occidentale*.

INTRODUCTION

The golden snail is one of the main pests on rice plants (Pérez-Méndez *et al*., 2022; Roonjho *et al*., 2021; Saad *et al*., 2023). Golden snail attacks on rice plants occur in various countries such as China, the Philippines, India, Brunei, Cambodia, Laos, Malaysia, Myanmar, the United States, Brazil, Japan, Kenya, Thailand, Vietnam, Indonesia, and several other countries (Buddie *et al*., 2021; de Brito and Joshi, 2016; Horgan *et al*., 2021; Marwoto *et al*., 2018; Saad *et al*., 2023). This pest is the most invasive species in freshwater waters and rice paddies and can cause severe damage to rice plants (Gao *et al*., 2021; Retnowati and Katili, 2021; Roonjho *et al*., 2021). The golden snail damages by eating the leaves and stems of young rice seedlings that have just been planted up to three weeks after planting, resulting in death in rice plants (Buddie *et al*., 2021; Horgan *et al*., 2017; Rusli *et al*., 2018). It is assumed that no rice variety is resistant to the attack of the golden snail (Rusli *et al*., 2018; Saad *et al*., 2023). The annual losses caused by golden snail attacks in various Southeast Asian countries and outside Southeast Asia are estimated to reach USD 35 billion and do not include environmental damage (de Brito and Joshi, 2016; Rejab *et al*., 2023). Golden snails result in farmers having to replant in areas with high golden snail populations, so that the production costs incurred by farmers are higher (Rusli *et al*., 2018)

Various measures to control environmentally friendly golden snails have been carried out by farmers. Control by directly picking up golden snails and egg groups, and using ducks as natural enemies (Rejab *et al*., 2023) Control is also carried out

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by regulating water levels, installing nets in irrigation canals in rice fields, and planting old rice seedlings or hardened stems (Horgan *et al*., 2017) However, it is considered less practical by farmers, and the attack of golden snails on rice plants is also still high. This kind of control technique requires more labor, a long time, and high costs (Osman *et al*., 2021). The difficulty of controlling golden snails makes farmers choose synthetic pesticides to protect rice plants (Idris *et al*., 2020). Niclosamide and metaldehyde are the most commonly used synthetic molluscicides that effectively control golden snails (Joshi *et al*., 2008). However, these chemicals are used arbitrarily, thus causing environmental pollution and killing non-target organisms as well as causing economic losses due to environmental damage (Chiu *et al*., 2014; Singh *et al*., 2010). Therefore, its use should be limited or replaced with natural plant chemicals (Bakar *et al*., 2022; Saad *et al*., 2023) Natural materials of plants that have been researched as control of golden snails such as lantana camara (Roonjho *et al*., 2021), (Roonjho *et al*., 2021) Furcraea plants (Rejab *et al*., 2023), Pueraria peduncularis, phaleria macrocarpa which can cause death in golden snails. However, because this vegetable material is difficult to find and limited in quantity, farmers in Indonesia are less interested in using it. Several types of plants are abundant in their availability and contain potential secondary metabolites to control the golden snail. *Agave angustifolia var. marginata*, cashew (*Anacardium occidentale)*, and rambutan *(Nephelium lappaceum*) plants contain secondary metabolites such as saponins, tannins and flavonoids, alkaloids (Dao *et al*., 2021; Dougnon *et al*., 2021; Pereira *et al*., 2017; Sujono *et al*., 2023)

This study aims to determine the efficacy of molluscicide leaf flour from Agave angustifolia leaves, cashew leaves, and rambutan leaves on the mortality of golden snails. This research will be the basis for producing environmentally friendly golden snail control technology in the form of plant-based molluscicide formulations that are effective in controlling golden snails and are easy to adopt by farmers. It is hoped that the findings from this study will not only be used to control the golden snail pest. But it can also control some types of pests that attack crops. This research will also contribute to the reduction of environmental pollution due to the use of synthetic molluscicides. There has yet to be any previous research that uses these three types of plant materials to control golden snails. Therefore, research is needed to determine the ability of molluscicide flour Agave angustifolia, cashew leaves, and rambutan leaves to control golden snails.

MATERIALS AND METHODS

***Materials*:** The materials in this study were adult stadia of golden snail, leaves of Agave angustifolia, cashew leaves, rambutan leaves, well water, food dehydrator, glass jar, and herb grinder.

***Preparation of the Golden Snail*:** The golden snail used is an adult stadia golden snail with a diameter range of 2-3 cm. A total of 300 golden snails were taken from rice fields in the Jenetallasa neighborhood, Parangluara Village, North Polombangkeng District, Takalar Regency. The golden snail is stored in a basin filled with well water and given feed in the form of gamal leaves. Every 24 hours the water in the basin is removed and replaced with clean well water.

***Preparation of Plant Leaf Powder*:** Leaves The plants used are rambutan leaves, agave angustifolia leaves and cashew leaves. The rambutan leaves and cashew leaves used are dark green leaves. While the agave leaves used are leaves that are close to the base of the stem. A total of 2 kg of each type of leaf is taken and then cleaned from dust by wiping it using a dry cloth. Next, it is cut into small pieces using a cutter or scissors. The leaves that have been cut into small pieces are dried using a food dehydrator at a temperature of 50^0C for 7 hours. The dried leaves are then powdered using a grinder machine for 5 minutes. The leaf powder is then filtered using a 100 mesh (0.15 mm) sieve. Each leaf powder is stored in a glass jar and is protected from exposure to sunlight.

***Bioassay*:** The experiment was carried out with a Factorial Group Random Design. The first factor is the type of plant molluscicide leaf powder which consists of angustifolia agave leaf powder, cashew leaf powder, rambutan leaf powder. While the second factor is the concentration of vegetable molluscicide which consists of six concentrations, namely 0.00 gr/L, 0.25 gr/L, 0.50 gr/L, 0.75 gr/L, 1.00 gr/L and 1.25 gr/L. So there are 18 treatment combinations. Treatment with 0.00 gr/L became the control of the study. Each treatment was repeated 3 times so that there were 48 experimental units. The experimental unit used a 3-liter clear jar filled with 1 liter of well water. Furthermore, 5 golden snails were introduced in each jar. The golden snail is acclimatized for 10 minutes. When all the golden snails are active, each of them is given 5 gamal leaves that have been cut with a size of 2 x 3 cm as food. Next, the application of plant leaf powder preparations is carried out according to the treatment. Plant leaf powder preparations when to be applied are dissolved first using 5 ml of water taken from each treatment container. After dissolved, it is then put into each treatment. Observations were made on the activity of golden snails, the intensity of attacks on gamal leaves, and the mortality of golden snails at 12, 24, 36, 48, 60 and 72 hours of exposure.

***Data analysis*:** The mortality of GAS is calculated using **Schneider-Orelli's formula (*Formula Mortalitas*, n.d.)**

$$\text{Corrected \%} = \frac{\text{Mortality \% in treated plot} - \text{Mortality \% in control plot}}{100 - \text{Mortality \% in control plot}} x\ 100$$

The mortality difference between treatments was analysis by analysis of variance (ANOVA) at a significance level (alpha) of 0.05 using SPSS. The average comparison was made using the Duncan New Multiple Range Test (DNMRT) at $p < 0.05$. Lethal Concentrate (LC) 50 and LC 90, as well as Lethal Time

(LT) 50 d and LT 90, were determined by Probit Analysis at a 95% confidence level using SPSS.

RESULT

***Mortality of Golden Snail*:** Molluscicides leaf powder from agave angustifolia, cashew, and rambutan showed different responses to golden snails during initial application. Molluscicide of Agave angustifolia leaf powder and cashew at concentration levels of 0.25 gr/L, 0.5 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L make the golden snail close the operculum so that the golden snail becomes inactive. When before the application of molluscicide, all the golden snails in the experimental container actively moved and stuck to the walls of the container. However, when the application of molluscicide is carried out, the golden snail immediately closes the operculum and that sticks to the wall of the container falls to the bottom of the container in an upside-down condition. At a concentration of 0.25 gr/L, the response occurred up to 1 hour after application, and then some golden snails returned to active movement but until 72 hours of exposure, there was no feeding activity carried out by the golden snails. Meanwhile, at concentrations of 0.5 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L, the golden snail no longer opens the operculum and is not actively moving. All golden snails do not change their position until mortality occurs. In the use of rambutan leaf powder at a concentration of 0.25, 0.5 gr/L at the beginning of the application of the golden snail does not immediately close the operculum and remains actively moving or sticking to the wall of the container. Meanwhile, at concentrations of 0.75 gr/L, 1.00 gr/L and 1.25 gr/l, golden snails closed the operculum and did not actively move or stick to the walls of the container. This happens until the golden snail experiences mortality which is indicated by the opening of the operculum, the legs wrinkled, the tentacles are not upright, and foam comes out of the golden snail's mouth. The characteristics of golden snails that experience mortality can be seen in Figure 1.

Figure 1. Symptoms of mortality of golden snails a. golden snails secrete foam, b,c: Operculum opens and the legs and body of golden snails wrinkle.

The use of molluscicides leaf powder from agave angustifolia leaves, cashew leaves, and rambutan leaves can cause mortality of up to 100% in golden snails. The ability to kill molluscicide leaf powder against golden snails differs based on the type of leaf and its concentration. The mortality rate of golden snails caused by the use of molluscicides leaf powder can be seen in the following figure 2-4.

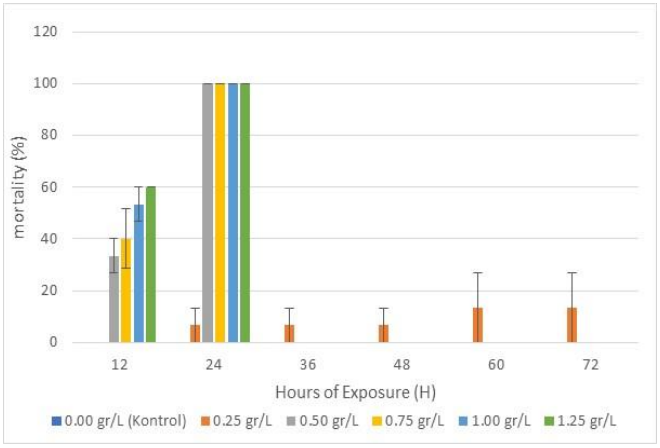

Figure 2. Mortality of golden snails in the use of molluscicide of *Agave angustifolia* leaf powder.

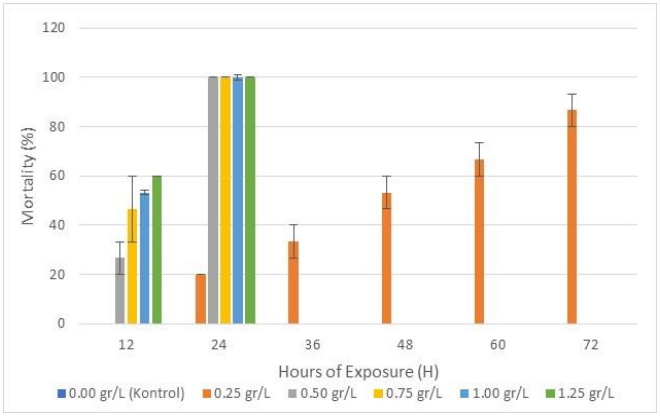

Figure 3. Mortality of golden snails in the use of molluscicide of cashew leaf powder (*Anacardium occidentale*).

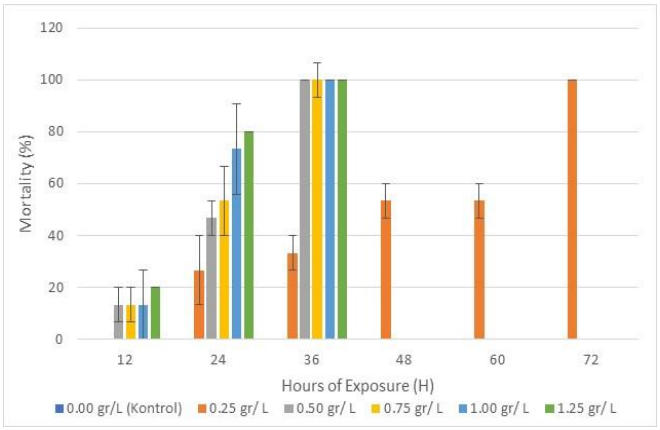

Figure 4. Mortality of golden snails in the use of molluscicide of rambutan leaf powder (*Nephelium lappaceum*).

The mortality of golden snails at a concentration of 0.25 gr/L of Agave angustifolia leaf powder and cashew leaves did not reach 100% until 72 hours of exposure. Meanwhile, the concentration of 0.25 gr/L in the use of rambutan leaf powder can cause 100% mortality at 72 hours of exposure. Concentrations of 0.50 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L molluscide leaf powder agave angustifolia, and cashews, caused 100% mortality at 24 hours of exposure.

Meanwhile, the use of Rambutan leaf powder at concentrations of 0.50 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L 100% mortality was achieved at 36 hours of exposure. The efficacy of molluscicide preparations of agave angustifolia leaf powder and cashew leaves is better than that of rambutan leaf powder preparations. The efficacy of molluscicides is the same as the mortality value caused by the golden snail. This is due to the absence of mortality that occurs in the study control. Thus, the value of efficacy is the same as the value of mortality.

Table 1. Average mortality of golden snails in the use of different types of molluscicides with different concentration levels.

Treatment		Average Mortality (%) + SE	
Types of Molluscicides	**Conc. (gr/L)**	**12 H**	**24 H**
Control	0.00	0.0±0.00a	0.0±0.00a
Agave	0.25	0.0±0.00a	6.67±6.67ab
Angustifolia	0.50	33.3±6.67bcde	100.0±0.00f
	0.75	40.0±11.55cdef	100.0±0.00f
	1.00	53.3±6.67ef	100.0±0.00f
	1.25	60.0±0.00f	100.0±0.00f
Cashew	0.25	0.0±0.00a	20.0±0.00bc
(*Anacardium*	0.50	26.7±6.67bcd	100.0±0.00f
occidentale)	0.75	46.7±13.33def	100.0±0.00f
	1.00	53.3±17.64ef	100.0±0.00f
	1.25	60.0±6.67f	100.0±0.00f
Rambutan	0.25	0.0±0.00a	26.7±13.33c
(Nephelium	0.50	13.3±6.67ab	46.7±6.67d
lappaceum)	0.75	13.3±6.67ab	53.3±13.33d
	1.00	13.3±13.33ab	73.3±17.64e
	1.25	20.0±0.00abc	80.0±0.00e

Numbers followed by the same letter in the same column and row do not differ significantly at a significance level of 5% using the Duncan test.

Molluscicide of Agave angustifolia leaf powder at 12 hours of exposure showed that the concentrations of 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L were not significantly different. The concentration of 1.25 gr/L was only markedly different from the concentration of 0.25 gr/L and the concentration of 0.5 gr/L. When compared to the 24-hour exposure time, the concentrations of 0.5 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L all caused 100% mortality. However, in the four levels of concentration, none showed a real difference.

The difference between the types of molluscicide is between agave angustifolia leaves and cashew leaves. This shows that these two types of molluscicides have the same efficacy in killing or causing mortality in golden snails. The two types of molluscicides show a real difference in the types of molluscicide of rambutan leaf powder.

The concentration of molluscicide preparation of leaf powder from agave angustifolia leaves and cashew leaves which has a high efficacy in causing mortality in golden snails with an exposure time of 24 hours is 0.50 gr/L. Concentrations of 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L can cause faster mortality but do not show a real difference with a concentration of 0.50 gr/L. Meanwhile, in the use of molluscicide of rambutan leaf powder. The concentration that has high efficacy in causing mortality in golden snails is a concentration of 1.00 gr/L which shows no significant difference in results with a concentration of rambutan leaves of 1.25 gr/L.

***Lethal Concentration 50% (LC50) and 90% (LC90)*:** The toxicity of molluscicide leaf powder of agave angustifolia leaves, cashew leaves, and rambutan leaves was measured by lethal concentration 50% and 90% in golden snails. Lethal concentrations of 50% and 90% can be seen in Tables 2 and 3.

Table 2. Lethal Concentration values of 50% (LC50) and 90% (LC90) of various types of molluscicides leaf powder at 12 hours of exposure.

Types of Molluscicides	LC50 (gr/L)	LC90 (gr/L)
Agave Angustifolia	0.98 (0.69 - 1.25)	1.65 (1.36 - 2.17)
Cashew (*Anacardium occidentale*)	0.97 (0.65 - 1.29)	1.62 (1.30 - 2.25)
Rambutan *(Nephelium lappaceum)*	1.94	3.13

The numbers in parentheses indicate the minimum and maximum confidence limits at the 95% confidence level

Table 3. Lethal Concentration values of 50% (LC50) and 90% (LC90) of various types of molluscicides leaf powder at 24-hour exposure time.

Types of Molluscicides	LC 50 (gr/L)	LC 90 (gr/L)
Agave angustifolia	0.36 (0.33 - 0.38)	0.46 (0.43 - 0.51)
Cashew (*Anacardium occidentale*)	0.32 (0.29 - 0.34)	0.42 (0.40 - 0.45)
Rambutan *(Nephelium lappaceum)*	0.69 (0.10 -1.01)	1.37 (1.05 - 1.92)

The numbers in parentheses indicate the minimum and maximum confidence limits at the 95% confidence level

The toxicity obtained from the probit analysis showed that at 12 hours of exposure to cashew molluscicide had the lowest LC50 and LC90, namely LC50 0.97 gr/L and LC90 1.62 gr/L. This showed that within 12 hours' exposure to molluscicide of cashew leaf powder was able to kill 50% of golden snails with a concentration of 0.97 gr/L and was able to kill 90% of golden snails with a concentration of 1.62 gr/L. LC50 and LC90 values of molluscicide of Angustifolia agave leaf powder are not much different, namely LC50 0.98 gr/L and LC90 1.65 gr/L. When compared with molluscicide of

angustifolia agave leaf powder, rambutan, and cashew leaf powder, then cashew molluscicide leaf powder has better toxicity within 12 hours of exposure.

The type of molluscicide of leaf powder that has better toxicity is cashew. The LC50 value of cashew leaf powder molluscicide was 0.32 gr/L and the LC90 value was 0.42 gr/L at 24 hours of exposure. The molluscicide of leaf powder from agave angustifolia is not much different from of molluscicide of cashew leaf powder, namely LC50 0.36 and LC90 0.46. Meanwhile, LC90 from molluscicide of rambutan leaf powder is LC90 1.37 gr/L or three times higher than molluscicide for cashew leaf powder and agave angustifolia leaves.

***Lethal Time 50% (LT50) and 90% (LT90)*:** The toxicity of molluscicide of leaf powder was also measured based on the fastest mortality time of 50% and 90% at each concentration level. Level of concentration and mortality time have inversely proportional values. The higher the concentration, the lower the time it takes to mortality the golden snail pest to. The LT50 and LT90 values of various types of molluscicides of leaf powder can be seen in Table 4.

Table 4. Lethal Time Values of 50% (LT50) and 90% (LT90) of various types of molluscicide of leaf powder at several concentration levels.

Types of Molluscicides	Conc.	LT 50 (H)	LT 90 (H)
Agave angustifolia	0.25 gr/L	126.75	197.79
	0.50 gr/L	47.65	74.86
	0.75 gr/L	12.69	16.14
	1.00 gr/L	11.78	15.24
	1.25 gr/L	11.34	14.70
Cashew (*Anacardium occidentale*)	0.25 gr/L	47.65	74.86
	0.50 gr/L	13.67	17.13
	0.75 gr/L	12.23	15.71
	1.00 gr/L	11.78	15.24
	1.25 gr/L	11.34	14.70
Rambutan *(Nephelium lappaceum)*	0.25 gr/L	46.44	73.03
	0.50 gr/L	24.18	37.29
	0.75 gr/L	21.78	31.26
	1.00 gr/L	19.56	27.83
	1.25 gr/L	18.00	26.50

The types of molluscicides that have the best toxicity from the lethal time of 50% and 90% are molluscicides of leaf powder of cashew and agave angustifolia. These two types of molluscicides have the same fastest time to mortality at a concentration of 1.25 gr/L, namely LT50 11.34 hours and LT90 14.70 hours. When compared to rambutan leaf powder molluscicide, the lethality of 90% at a concentration of 1.25 gr/L takes 26.50 hours, or the time difference with cashew powder molluscicide and agave angustifolia of 11.8 hours.

***Attack Intensity*:** The use of molluscicide of leaf powder of agave angustifolia, cashew leaves, and rambutan leaves, causes the golden snail to close the operculum after the molluscicide application is carried out. The closure of the operculum makes the golden snail unable to eat the Gamal leaves prepared as feed. So that there was no damage to Gamal leaves or no attack of golden snails on Gamal leaves from the beginning of exposure to 72 hours of exposure in all molluscicide treatments from concentrations of 0.25 gr/L, 0.5 gr/L, 0.75 gr/L, 1.00 gr/L, and 1.25 gr/L. The intensity of attacks that occurred in the control reached 100% at 12 hours of exposure and increased by 100% every 12 hours to 72 hours of exposure. The same amount of Gamal leaves in the control was added when the previous gamal leaves were eaten 100% by golden snails.

DISCUSSION

The use of molluscicides of leaf powder from agave angustifolia leaves, cashews, and rambutan causes the golden snail to close the operculum. This is done by the golden snail in response to the active ingredient contained in molluscicides which are considered to harm the golden snail. The closure of the operculum in the golden snail is possible because the short tentacles as a chemoreceptors have detected and received chemical stimuli or there has been exposure to the active ingredient in the body part of the golden snail or the active ingredient is detected after tasting so that the golden snail chemoreceptor responds by closing the operculum to avoid greater exposure. Animals recognize and distinguish chemical cues in the environment through smell or taste, thus obtaining information that influences their behavior with the goal of survival (Yu *et al*., 2023).

Molluscicides of leaf powder of agave angustifolia, cashew and rambutan can cause mortality to golden snails at various levels of concentration. This shows that the three types of plant-based molluscicides have toxic compounds against golden snails. Mortality in golden snails is due to the use of molluscicide of leaf powder of agave angustifolia, cashew and rambutan because the plant-based molluscicide contains secondary metabolites that are toxic (de Brito and Joshi, 2016). Agave angustifolia contains saponins, flavonoids, and tannins (Pereira *et al*., 2017), Agave extract is rich in bioactive compounds, such as saponins, phenolic compounds, and terpenes, and has biological effects such as antimicrobial, antifungal, antioxidant, anti-inflammatory, antihypertensive, immunomodulatory, antiparasitic, and anticancer (López-Romero *et al*., 2018). Cashew leaves contain tannins, saponins, alkaloids, flavonoid, glikosida, and steroid saponin (Abulude *et al*., 2010; Dougnon *et al*., 2021). Meanwhile, rambutan leaves contain saponins, flavonoids, and phenols (Sujono *et al*., 2023)

Mortality that occurs in golden snails is caused by the presence of saponin content in leaf powder. Some studies showed that the use of saponins can cause mortality in golden snails (de Brito and Joshi, 2016; Joshi *et al*., 2008). Saponins can disrupt the respiratory system of the golden snail and damage the blood cell wall of the golden snail. Saponins can

also damage cell membranes of cold-blooded animals (Desai *et al*., 2009). The golden snail reacts with saponins or toxin compounds present in molluscicides by secreting mucus which aims to reduce the contact of the body's surface with molluscicides. However, excessive mucus formation will inhibit respiration where oxygen diffusion through the gills is blocked by mucus and then experiencing mortality (Desai *et al*., 2009).

Several studies have found that Agave species such as A. filifera, A. celsii, A. sisalana, A. decipiens Baker, and A. lophanta have molluscide activity against Biomphalaria alexandrina. Agave angustifolia contains tigogenin diglycoside and is able to kill 90% of the population of B. alexandrina at a concentration of 61.4 mg/L after 24 hours of exposure (Bermúdez-Bazán *et al*., 2021). Meanwhile, rambutan leaves can be used as an insecticide because they are toxic to several types of pests and are also anticancer (Costa *et al*., 2020). The mortality rate of golden snails caused by molluscicides of leaf powder of agave angustifolia, cashew, and rambutan is directly proportional to the concentration level. The higher the concentration of molluscicide in leaf meal, the higher the mortality of golden snail. Mortality that occurs at a concentration of 1.25 g/L is higher and faster when compared to lower concentrations. However, based on variance analysis, the concentrations of 0.50 g/L, 0.75 g/L, 1.00 g/L, and 1.25 g/L did not differ significantly. This shows that the concentration of 0.50 g/L is the lowest concentration that is as effective as the higher concentration in causing mortality against golden snails. It also shows that the content of secondary metabolites at a concentration of 0.50 g/L is sufficient to cause mortality in golden snails.

Molluscicide of leaf powder of agave angustifolia, cashew, and rambutan are easily soluble in water because these materials come from fresh leaves that are dried by the dehydrator method. So, when added to water, the active ingredients in the powder almost resemble the conditions in fresh leaves. This makes it easy to react in water so that it is quick to exposure or make contact with the body surface of the golden snail. The particle size of molluscicide of leaf powder is 100 mesh or 0.149 mm, this size is a very small particle so the surface area of the particles becomes large and increases the reaction rate in water. In the form of 100 mesh of agave leaves and cashew leaves at concentrations of 0.5 gr/L, 0.75 g/L, 1.00 g/L, and 1.25 gr/L can cause 100% mortality in golden snails during 24 hours of exposure. Meanwhile, molluscicide of leaf powder of rambutan with concentrations of 0.5 gr/L, 0.75 g/L, 1.00 g/L, and 1.25 gr/L caused 100% mortality at 36 hours of exposure. Rambutan leaf powder of the same size as agave angustifolia leaf powder and cashew showed slower activity in causing mortality to the golden snail. This happens because rambutan leaf powder when dissolved in water will form mucus and rambutan leaf particles will unite with each other. So, it takes longer for contact with the body surface of the golden snail. This causes the slow mortality of golden snails in the use of molluscicide of leaf powder of rambutan.

***Conclusion*:** Leaf powders from agave angustifolia, cashew, and rambutan is effectively used as a molluscicide to control the pest of the golden snail. Molluscicides of leaf powders of agave angustifolia, cashew, and rambutan and the concentration level in each type of molluscicide significantly affected the mortality of golden snails. Molluscicide of leaf powder of cashew is more effective than agave angustifolia and rambutan. However, mortality caused by molluscicides of leaf powder of cashew was not significantly different from molluscicide of leaf powder of agave angustifolia. The mortality of golden snails from molluscicide of leaf powder of cashew and agave angustifolia was markedly different from molluscicide of leaf powder of rambutan. Lethal Concentrate 90% (LC90) within 24 hours of molluscicide of leaf powders of cashew is 0.42 gr/L, agave angustifolia 0.46 gr/L, and rambutan 1.37 gr/L. Molluscicide of leaf powder of cashew can cause 90% mortality within 24 hours in golden snails with a concentration of 0.42 gr/L.

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